The Antinomies of Contemporary C&T

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Summary

1. Paradoxical changes

Contemporary science and technology is going through rapid and paradoxical changes, difficult to interpret in simplified terms. It is getting more global, and more concentrated; it requires more skilled, and less skilled manpower; it is more applied, and more basic; more linked as ever to private initiative, and more dependent on public policies and governmental support. In the following, I will try to spell out some of these seemingly contradictory trends, and the policy implications they entail.

It is enough to look around to see how modern science and technology is pervasive, invading all kinds of human activities and regions. Less obvious is that S&T is becoming ever more esoteric, being understood, practiced and utilized only by a small)) and probably shrinking)) part of the world, and of each society.

This notion is in stark contrast with the conventional wisdom, which assumed that science and education were part of a global and irreversible trend towards increasing rationalization and scientification of mankind, which would eventually encompass all societies, although at different paces. Several facts, in the industrialized countries, seemed to confirm this trend: the expansion of education at all levels; the growing importance of scientific and technically-based professions, replacing the old, humanistic traditions; the popular fascination with the achievement of modern science, generating large groups of amateur scientists and technological tinkerers, and attracting brilliant minds to scientific careers; the growing investments for research coming from all kinds of government and

private agencies and institutions; and, more recently, the expansion of knowledge-based economic activities.

2. Modern science and scientific culture

In the early nineties, several of these trends are being reversed, or are showing signs of moving into unexpected directions. As modern science and technology becomes more complex and expensive, requiring many years of hard study and specialization, the use of sophisticated and costly equipment and the adoption of ever more esoteric languages, the distance between scientist and layman increases, and science and its products come to be perceived as endowed with magic qualities. In the past, not everybody could be an Thomas Edison or a Rudolf Diesel, but it was not difficult for a person of average education to understand how a telephone or a car worked, and to tinker with them if necessary. Even radios could be disassembled and assembled with a little more than a screwdriver, and popular science magazines and courses-by-mail gave the necessary information at modicum prices. Today, most products of high technology reach the consumers with a label, "no user serviceable parts inside," and he who dares to open them can only see incomprehensible printed circuits and an assortment of black chips.

One visible consequence is the disappearance of the old scientific and technological hero, the individual "inventor," with no replacement in sight. In the past, figures like Graham Bell, the Wright brothers or Santos Dumont captured the people's imagination, not only because of the cleverness of their inventions, but because they seemed only a few steps ahead of any undertaking, reasonably skilled, and perhaps slightly crazy person. At the turn of the century, different countries claimed their own inventors of the airplane, the horseless carriage or the photographic camera as sources of national pride and inspiration. The scientific heroes of our times, however, are best typified by Albert Einstein and Stephen Hawking, admired as super-natural men, privy to the mysterious understanding of incomprehensible mathematics and strange theories about the origins and nature of the universe, which no average person could possibly expect to grasp.

Thus, as science becomes more pervasive, and education more widespread, there are reasons to believe that there is less of a "scientific culture" among the educated today than in the past. Education expanded at all levels in the industrialized countries on the assumption that it would be possible to spread out the "two cultures" of science and the humanities to the population as a whole, and that they would somehow complement and interact with each other. That they remained apart is the classic thesis of C. P. Snow, which need not be elaborated again. The question of what the "humanistic culture" should be is the subject of heated arguments in the United States and elsewhere, about the need of a "core curriculum" in colleges and in secondary schools, or on the eventual race and sexist biases in traditional course programs. The fate of the "scientific" side of education has not been discussed as heatedly, except by the concern about the long-term falling rates of achievement of American students in standardized tests, in comparison with Japan and some other countries.

The usual assumption underlying the teaching of science in basic and secondary schools was that there is something specific that could be called "scientific method," or a scientific way of thinking, different (and better) than the workings of uncultivated minds, which could be suffused to the students through formal education. It is clear today that there is no "scientific method" as such, disembodied of substantive research fields and traditions, which could be used to prepare the minds for future scientific work. Initiation in science, as Thomas Khun has shown, takes place through the contact with exemplars which are central to the different disciplines. But the exemplars of contemporary science are more remote than ever from what can take place in a standard classroom. What general education can do, and has done more or less successfully in many cases, is to shape attitudes)) to convince people about the value of science, and to make them used to the hardships of disciplined and concentrated work. This is why education in Japan and a few other countries

can be simultaneously so conservative pedagogically, and so efficient in getting good people into technological research. The United States, with a much richer experience in trying to foster creativity, curiosity and initiative in the students, seem much less successful in transforming their youth into professional, hard-working researchers. This is one of the reasons of the dearth of scientific vocations which is felt today so strongly in the US.

The situation was made more difficult by the universalization of secondary education, and the transformation of higher education in mass systems. Small, homogeneous countries may not feel the problem as strongly, but they are striking for large, multi-ethnic societies like the United States and Brazil, India or Indonesia. Educational systems in these societies are patchworks of cross-crossing cultural traditions and value systems, which could not possibly be made homogeneous by the sheer transmission of standardized educational contents through the classroom, even if their schools worked properly and were well endowed with teachers and resources, which they are often not. What reaches the students who remain at the fringes of modern education, in the name of science and the humanities, is fragmentary, difficult to learn, and often meaningless both for the students and their teachers. Thus the growing demands for vocational education, in spite of its obvious inadequacy to the knowledge requirements of contemporary societies (but more on that below); and the preference for courses related to the building up of collective identities and simpler cosmogonies than those provided by the hard and uncertain road to science. If this kind of knowledge cannot be obtained within the formal education institutions, it is easily available elsewhere, leading to widespread adoption of "alternative" views of society, from the search of Oriental wisdom to computer-driven astrological maps, from the adoption of homeopathic medicine to semi-magic commitment to "organic" foods. With a few exceptions, these alternative cosmogonies and life-styles do not require rejection of the products of advanced technology, from cars and motorcycles to TV sets and VCRs, or the use of computerized information and data banks. There is a remarkable paradox here, if one thinks in the tradition and promise of Western science, of being the harbinger of rationality. Today, the cargo cults discovered by bewildered anthropologists among primitive societies can be found much closer home than they could ever suspect.

3. Globalization and concentration

The current speed in communications and the ability to spread out information cheaply, and almost immediately, throughout the world, do not seem to be leading to a better distribution of scientific competence, but to its increasing concentration. The phenomenon is similar to what happens when highways are built linking modern, central cities to less developed areas and regions. The most able leave their regions, old leadership loses prestige, local industry is killed by mass products arriving in truckloads. There may be a sequence in what the peripheral region receives from the center. First the consumption aspirations, then the packaged products, then some jobs for unskilled activities in trade and service, and later, eventually, some parts of the productive and scientific organizations and institutions themselves (labor intensive and environmentally hazardous industries, distribution centers, technical assistance departments, administrative branches, installations, even laboratories). It is not certain that this sequence is ever fully completed. Globalization is extremely effective in destroying local culture and organization, but uncertain at best in its ability to replace them with truly universal alternatives.

Part of this process is the combination and coexistence of standardization and diversification tendencies. This is specially clear in the publishing industry and the mass media, but is not limited to them. The publishing industry in the industrialized countries depend today on a small number of best-seller books that are sold by millions through hundreds of standardized outlets, and supported by very elaborate and expensive merchandizing. Local newspapers are a thing of the past, being replaced by national and international magazines, the same applying to radio and TV stations, replaced by national and even global networks. Not only the number of best-seller books, newspapers and

magazines are small, but they tend also to restrict themselves to a narrow set of issues, questions and personalities, creating a very small and provincial world in a global scale.

Modern communications technology, however, is also spurring an opposite trend. Personal computers have turned small-scale publishing a very affordable and simple activity, cable and satellite television threaten at both ends the monopoly of national TV networks, and the lower costs of communication allows information to flow simultaneously in all directions. It would be possible to imagine that the tendency for concentration and growing asymmetry is now being replaced by a new trend for diversification and increasing complexity. It is more likely, however, that the two tendencies will coexist, as two sides of the same coin: on one side, small, increasingly complex and diversified communities of producers of modern technology and consumers of its more sophisticated products; on the other, the consumers of its packaged products.

The way this transformation is affecting Science and Technology has not been sufficiently explored, but here again paradoxes are likely to occur. With the recent explosions in computer networking, it is almost as easy to work with first-rate information and computer power in a remote place of Latin America or Asia as in Boston, and cooperative projects are much freer than before from geographical limitations and constraints. The lack of good libraries and journals, a chronic problem in less developed regions, will tend to disappear in a few years, as remote access to integrated data bases improve, and fax transmissions become cheaper. For a scientists leaving their institutions and laboratories to work in remote regions, work can continue as if he had never left)) his laboratory, in practice, is now the world. For scientists and technologists from peripheral areas and institutions, however, the effects can be devastating. He will have no excuses for working in his native language, or in questions different from what is attracting the attention of his colleagues in the main centers. He will be measured against his peers in these centers, not against those in their own institution or region. There will be less reasons to spread human and technical resources geographically. The "Matthew effect" will increase to extraordinary proportions, driving whole research institutions and generations of scientists into obsolescence.

4. More and less skills

The complex products of modern science and technology are becoming more simple and "user-friendly," not only for the final buyer of consumer goods, but also for the worker in the assembly line. There are two opposite interpretations of this trend. One is the theory of *deskill*, meaning that, as knowledge gets more concentrated, labor gets less qualified. The evidence for this is the growing utilization of cheap, disciplined workers (usually young women) in assembly lines of less developed countries in the production of sophisticated products in electronics and high technology consumer goods. A good example are the "maquiladora" industries in Mexico, which reproduces a pattern widely adopted in many Asian countries.

The other interpretation argues that deskill was a feature of the previous industrial revolution, with the introduction of taylorism and fordism; modern industrial production requires better educated and better trained persons, able to understand and carry on with their work in a comprehensive, rather than piecemeal approach. Those who cannot learn new skills and abilities (mostly generic skills, the ability to learn and to adapt) will be left out of the modern world; people, regions, countries. Sobel and Piore argue that this represents the establishment of a new "industrial divide", equal in importance to the introduction of mass production through detailed division of labor at the turn of the century, made famous by the Ford Motor Company; a new era that gives considerable advantage to countries which were able to retain their craftsman's traditions from the 19th century through the modern times. The point is also central also to Michael Porter's *The Comparative Advantages of Nations*. For him,

> achieving more sophisticated competitive advantages and competing in advanced segments and new industries demands human resources with improving skills and abilities. The quality of human resources must be steadily rising if a nation's economy is to upgrade . . . (p.).

Highly skilled and motivated labor is not just a requirement of modern, high technology industries; it also ensures that the profits derived from modern technology will remain in the hands of their producers, leading to a positive circle of growing prosperity and competence.

David Joravsky has argued that technology by itself does not require less or more skills, but can be adapted to the skills of the users. If the user - and the worker - has sophisticated skills and learning, technology will be developed to make use of his ability; if he has very limited skills and competence, then technologists will develop dumb-proof procedures and routines. More important than the skill itself is the users' ability to put science and technology at their service:

> We tend to assume that increasing automatic capacity in machinery necessarily depresses skill and status in workers, whether male or female, that the automation of work entails the replacement of 'tool users' by 'machine tenders', as Thomas Hughes has neatly labeled a major feature of industrialization. Is that depression of skill, that crippling of autonomy among people who work with machines, an unavoidable cost of technological progress? I note that it is avoided when the status of workers specifies avoidance, as it does, for example with respect to physicians and plumbers. In those trades mechanized equipment is devised to enhance the use of knowledge and manual skills, not to depress it (p. 12).

This view frees us from technological determinism, and points to a division of labor that is already taking place between the high technology nations and regions and the rest of the world, with the most complex tasks (and higher profits) being reserved for the first, and the routine (and cheaper) tasks being exported to the latter. Automation, however, reduces the need for unskilled, disciplined labor, leaving the lower technology regions just as consumers - but without the revenues to pay for the goods. Modern science and technology is compatible with a skilled population and an educational system providing the general skills needed to handle modern equipment and services, and is also compatible with a world of consumers who just learn how to press buttons, and dumb producers are bound to be replaced by automation. The first will be better off than the latter, because of the additional income generated from the work of a better skilled population.

5. Growing investments and dwindling resources

The transformations described above coincide with a generalized crisis of the welfare state, which does not seem related to the relative wealth of each country. At different levels, but around the same time in the 1980's, most countries seem to have exhausted their ability to increase the transfer of resources from the productive sector to areas like education, health, pension benefits and long-term research. This condition seems to contradict the notion that science and technology are more important today than they ever were, and are receiving larger and larger resource inputs, at least in the major industrialized countries.

Two major trends explain this possible discrepancy. The first is that investments in S&T tend to be directed increasingly to the industrial sector, and carried out by industries and governments outside the traditional scientific institutions like universities and centers for basic research. The second is that, in the basic sciences, there is a growing concentration of resources in a few extremely large projects. A recent survey by *Science* on the perspectives for scientific careers in the US for the next decade pointed to a constant

pressure to concentrate resources to areas defined according to their social and economic relevance)) industrial, military and educational research)) which are perceived by many as a threat to the country's scientific capabilities on the long term. This quest of practical results comes together with huge investments in a few large projects in basic sciences, in the fields of high energy physics and space exploration. The projection is that, if the U.S. expenditures for S&T grows at about 3% a year in the next decade, four projects alone would absorb all this increase)) the Superconducting Collider, the Human Genome Project and two projects by NASA, the space station and a system of earth monitoring. One side effect is the "collectivisation" of scientific activity, which is perceived by many as a threat to the inovativeness of individual leadership and small groups, and a desincentive to gifted and promising students to enter the scientific careers.

6. Away and back from the universities

Applied research and large-scale laboratories mean that modern science cannot remain easily within the confines of university departments and academic centers, leading to a host of new institutional arrangements, linking government, industry, universities and private consultancy groups in different ways. Countries with a tradition of university-based research feel that this tradition is being threatened by the encroachment of industry and the profit-making mentality and values; countries with strong traditions of non-university research feel the need to link their research institutions more closely with academic institutions, to be more open to innovation and intellectual competition.

The movement from the traditional sites of research to non-traditional contexts is also taking place in the broader field of education. A multi-billion dollar knowledge industry has developed outside the established educational institutions, responding in a much more direct, and usually more effective way, to the needs of industry and the labor market than before, and leading to the corrosion of the monopoly the universities have enjoyed in providing knowledge and granting educational credentials with good currency in the private sector. A recent Wall Street Journal report indicated that US companies are spending about 30 billion dollars a year in education, a value which is likely to go up, since it "still only amounts to 1.5% of total payroll and involves only 10% of the work force" ("Back to Basics", p. R14). IBM alone spent about $270 million, or 9% of its revenues, in training in 1989. Writing on the same vein, Sir Douglas Hague has stated that,

> In the 1900s and 2000s, people *outside* the universities will increasingly be working in similar ways and with similar talents than those within; and they will often do so more inovatively and with greater vigour, because they will come to what they do untrammelled by academic traditions, preconceptions and institutions. The pioneers of the knowledge society will increasingly be able to compete with the universities and, increasingly, will do so. (. . .) To avoid being driven out of activities which they have imagined their own by right, the universities will have to make substantial changes in what they do and how they do it. Where they find that difficult, one solution will be to form alliances with the interlopers. Increasingly, the choice will be alliance or annihilation (p. 12-13).

These realities have led to a belief in the approaching demise of academic research as we have known it. Academic science cannot sustain itself without industry; there are actually no distinctions between basic and applied research; universities have to mingle with the knowledge industry, and be run like private corporations; governments are hopelessly incompetent and inefficient to plan for science and education. These notions are a step ahead of the 1971 Rothschild Report in England, which introduced a sharp distinction between academic science, the province of universities and research councils, and applied work, to be contracted out by different sectors in government and subject to long-term planning. In those years, there was still a place for basic research, and a belief in the

governments' ability to set policies in this field. In the nineties, the distinction between basic and applied research seems to have disappeared, everything is supposed to be geared by the expectations of profits and practical results, and the faith on the government's ability to plan ahead has disappeared, being replaced by the beliefs about the virtues of the private initiative (but more on that below).

In their evaluation of the Rothschild Experiment, Kogan and Henkel wrote that

> in the light of later experience, the Rothschild formula can be criticized for assuming that government departments were the only source of policy development, that they could state all the requirements from their own sources of knowledge and problem-setting. It failed to note how in those areas of policy where data are diffuse, and analyses most likely to be strongly influenced by value preferences, problems must be identified collaboratively between policy maker and scientist (p. 9).

In their conclusion, they note that "government and science contain elements of convergence and divergence.The boundaries of both are permeable and moving. (. . .). There are degrees of 'finalization' and different starting points: some from the rigors of academic disciplines, others from social problems and domains of concern. Because government and science are both multimodal and change as they interact with each other, it becomes clear that no single or simple model of science policy is appropriate (. . .) (p. 163.)

7. Government policies and private initiative

The growing role of industrial and applied research and the emergence of a thriving business-driven knowledge industry have led to the impression that public supported science, technology and even education are things of the past, to be replaced by private initiative. The reality is much more complex.

A first evidence comes from Japan and the "Asian Tigers," including Korea, Singapore and Taiwan. These countries tend to be presented as success cases of free market and competition, in contrast with the problems of centralized, state-driven economies like France, India or Brazil, which have failed in their best efforts to join the first ranks of technology driven, industrial competitiveness in the contemporary world. One thing the "Asian Tigers" have in common, however, is that they are or have been garrison states until recently, and that their economic achievements have resulted from much closer links between the public and the private sector than it was ever possible to obtain in many other countries. Criticizing the "mistaken tendency to identify export-oriented growth strategies with free market policies," an observer notes that

> More detailed case studies of the Asian NICs [New Industrializing Countries] and more thoughtful reflection subsequently revealed the actual heterodoxy of the policy mix pursued by the successful exporters of manufactures. In fact, a considerable amount of government intervention has taken place in the successful NICs. Public policy is now understood to by most observers to play a fundamental role in achieving an outward-oriented economic thrust, quite apart from the degree of reliance on the market involved in each instance (Bradford, p. 122).

In contrast to the Asian Tigers, Brazil is often cited as an example of a country which failed in its development drive because of excessive state interference in the economy. Until the late 1970s, however, Brazil had one of the highest economic growth rates in the world, and its ability since the early eighties to generate huge trade surpluses to pay for its foreign debt can be credited to the government's ambitious programs of industrial and technological development and modernization in the 1970s. There is a

running debate about the reasons of the crisis and stagnation in the 1980's, with explanations going from the exhaustion of the import-substitution drive in the previous decade to the economic constraints of the foreign debt, or to the consequences of over-ambitious investments and an ever-growing and wasteful bureaucracy built during two decades of military rule, between 1964 and 1984, of which the debt is one consequence. There are no signs, however, that the private sector alone will be able to replace the state in the drive towards economic readjustment, industrial modernization, scientific and technological qualification and education.

Another example is France, a country that has suffered in some of its government-driven attempts to breach the technological gap with international competition, like in computers, car manufacture and electronic consumption goods. But some of its government-supported projects are unquestionable success stories both from an economic and industrial point of view, like the TGV, the nuclear energy program and in telecommunications. In a recent survey, *Times Magazine* noted that

> In the 1970s, pressured by the oil embargo and fear of falling behind its German neighbor, France decided to simultaneously rebuild its transport network, update the telecommunications system and revolutionarize its power-generating structure. Those projects alone account for some $250 billion in long-term investment. (. . .) In scope and execution the schemes would be familiar to the centralized planners of Eastern Europe)) minus the inefficiency ineptitude. The projects have been designed, financed and carried out by the state, drawing on the expertise of the private sector but relying heavily on the leadership and drive of an army of specialized civil servants, who serve France as a secular priesthood. All the projects involve large-scale state-run companies and secretive interlocking bureaucracies where public scrutiny is limited. All are controversial (. . .). (p. 20).

A scholarly study of the French effort in information technologies, done a few years early, came to a similar conclusion:

> It would be premature (. . .) to count the French out completely. The industry stands poised to profit from some undeniable strengths, including a highly skilled workforce, a flourishing computer-services sector, pockets of managerial brilliance, and a relatively undeveloped but rapidly expanding market at home and in select regions abroad. Moreover, certain underlying trends in high technology, particularly in the fusion of data processing with telecommunications, are potentially quite favorable to a national industry whose government knows how to use its full powers to marshall supplier and consumer in the service of collectively defined objectives (Brickman, p. 85).

8. Policies: complex realities, simple myths

The antinomies discussed in the above paragraphs have placed the whole question of national and international policies for science and technology on shaky grounds. The Second World War consolidated the belief that science was important, not only for winning wars, but also to get the dividends of peace. After the War scientific research seemed to be a cornucopia opened to all countries, and science councils were created everywhere, often with support and incentive from the United Nations, national foreign assistance agencies and private foundations from the industrialized countries. The assumption was that, with scientific institutions in place and adequate scientific education, all countries could participate on a relatively equal foot on the benefices of modern science and technology. What we have witnessed in the last ten or twenty years is that this assumption does not hold anymore. It is not only that most of third world countries failed in their attempt to build modern, high quality scientific institutions, but even relatively well developed and well

educated countries (like those in Europe and, of course, in the socialist block) started to realize that their scientific and technological assets were becoming obsolete. It is not clear whether the recent efforts of increasing investments in S&T and establishing networks of international cooperation in Western Europe are sufficient to keep pace with the United States and Japan; what is certain is that no other countries and regions are following suit.

As the complexity and contradictory nature of contemporary science and technology unfolds, the proposed solutions to current shortcomings tend to become more simple, or simple-minded, than ever. It is not difficult to understand way. Societies which were successful in building up scientific and technological institutions did it in an unplanned manner, within a broad movement of raising education, industrialization and the development of scientific and technological competence. Beliefs in the values of science and higher learning were taken for granted, and scientific, technological and educational activities were left more or less to the scientists, engineers and educators themselves, who would bargain with the government for the resources they needed, in exchange for the products they thought they could deliver. Here again, modern science and technology developed one among its many double faces. One, for society as a whole, claiming its disinterestedness in questions of profit and government, and their long-term benefits as sources of knowledge for industry and the learned professions. Another, for government authorities and political inner circles, offering short-term fixes to complex economic and social problems, and bargaining hard in scientific councils and other financing sources for support. It was possible to keep these two faces going as long as the general belief on the benefits of science and technology were maintained, and the scientists's high prestige granted them access to the ears and pockets of the holders of the public purse. Science (and, to a lesser degree, technology) could develop at the pace of the their own communities, adjusting gradually to external circumstances, but never losing ground in their ability to decide with independence what they were doing, and in which direction they were moving.

Whenever this delicate balance between two contradictory faces was challenged, science suffered. In the Soviet Union and the socialist countries, social sciences died by suffocation under the close embrace of party and government, and natural sciences also suffered. Several semi-developed countries tried to develop science and technology under close government supervision and for military purposes, or, at the other extreme, believed too naively in the desinteressedness and natural goodness of basic science for their societies, and none of these extremes worked well.

The novelty in the eighties and nineties is that this double face is becoming impossible to maintain even in the industrialized, capitalist countries. There is too much money involved, the benefits and risks of modern technology are too great, there are too many competitors, and the idyllic myth of the the Republic of Pure science suffered irrecoverable damage from the onslaught of social and intelectual criticism, within the academy and in real life. A closer look at past experiences will show that countries that were able to maintain complex, multi-faceted policies for science, technology and industrial development were more successful than those that tried to draw ambitious, long-range, comprehensive projects. In the limit, the United States never developed a science policy of any kind, except for broad decisions to raise or reduce the global level of investments in the sector.

The discussions about what can be done to redress the growing imbalances between center and periphery in science and technology is permeated by a series of contradictory assumptions which, for lack of proper evidence, can be considered as myths. We can call them "myths of the past" and "myths of the present".

The myths of the past consist in denying the realities and implications of the current changes. In some countries, they may appear as a nostalgia for the elite university, shattered by the ramifications of the 1968 student movement, and for the self-contained and high quality establishment of basic research, threatened by budget cuts and short-sighted demands for "relevance". On the universities, there is a growing literature on the failures of the post-1968 experiences of reform, and on the need to return to more traditional curricula

and the principles of intellectual hierarchy. On science and technology, there is a stream of articles trying to demonstrate the pitfalls of the attempts to move research away from academia and link it to business and government agencies. In countries of the third world, which never reached the levels of excellence of the traditional university and conventional basic research, there is the feeling that they were taken out of their path by economic and political circumstances, and should come back to it as soon as possible. If they just had the resources, they would soon be like Europe - but in the early sixties.

The myths of the future tend to be radical, catastrophic or romantic and utopian. The utopian vein is more in vogue. It is a belief on new era of progress, economic development and peace, brought about by the demise of socialism, the end of the cold war and the advances in science and technology. The optimists would accept that there are, of course, those are still to see the light, and countries which have still to shed off old illusions about central planning, the role of the state, culture and ideology. But they believe these people and countries will eventually come to their senses, and join the bandwagon of the new international order. The pessimists see only the contradictions, the emergence of nationalism and racism, the spreading of mass culture, the victory of irracionalism and the instauration of post-modernism.

As I see it, one of the main tasks of our enquiry into the anthropology and ecology of knowledge production system is to take stock of these powerful and contradictory myths, and find a space for accepting and understanding complexity for what it is.

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